

Uncle Sam Side Slope Lateral Movement - Update

Presenter: **Mosaic Fertilizer**

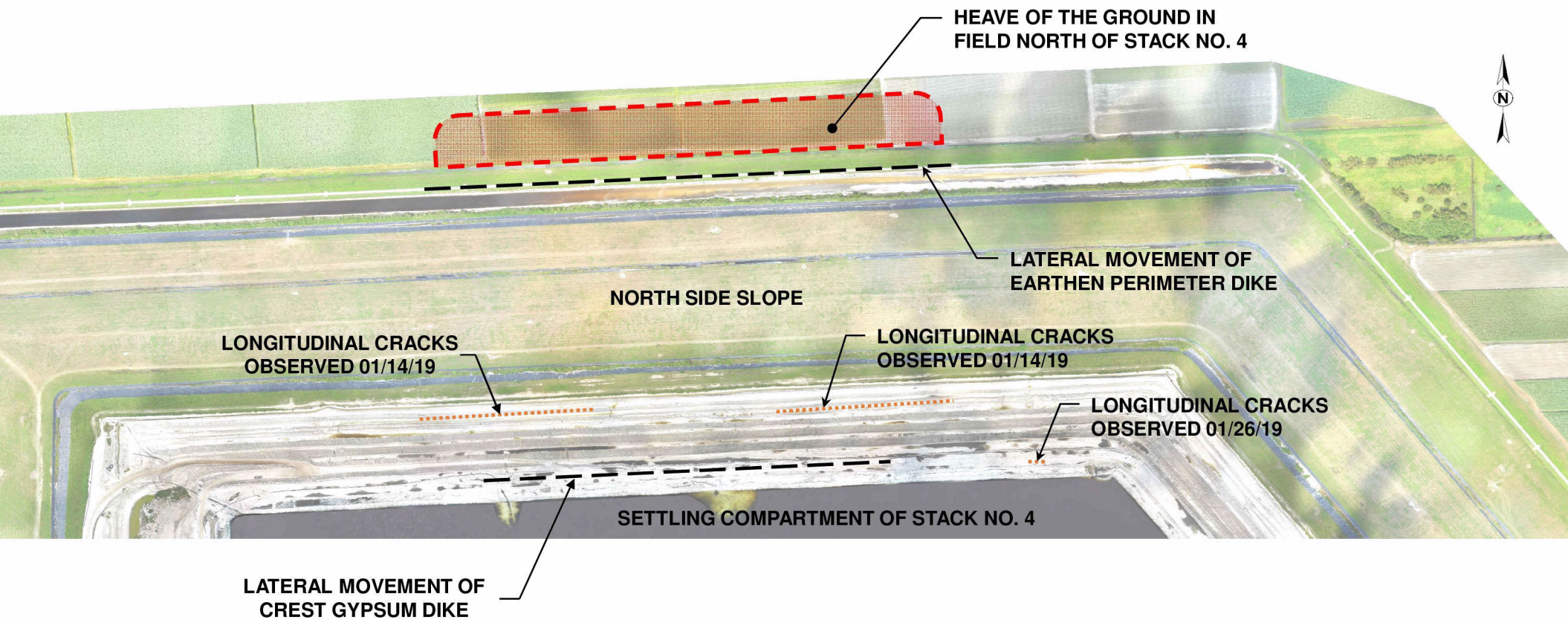
Date: February 11, 2019

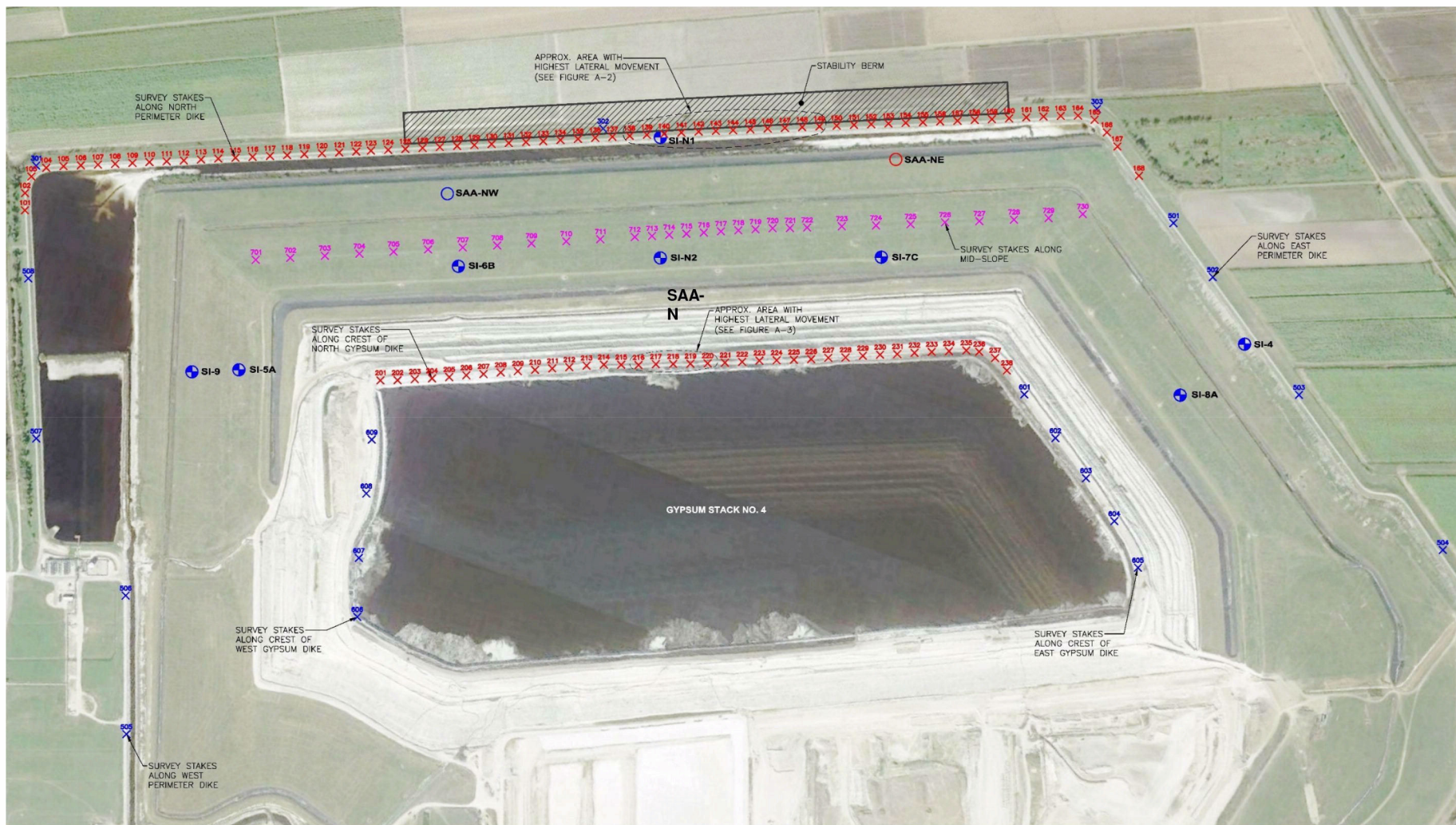


AGENDA

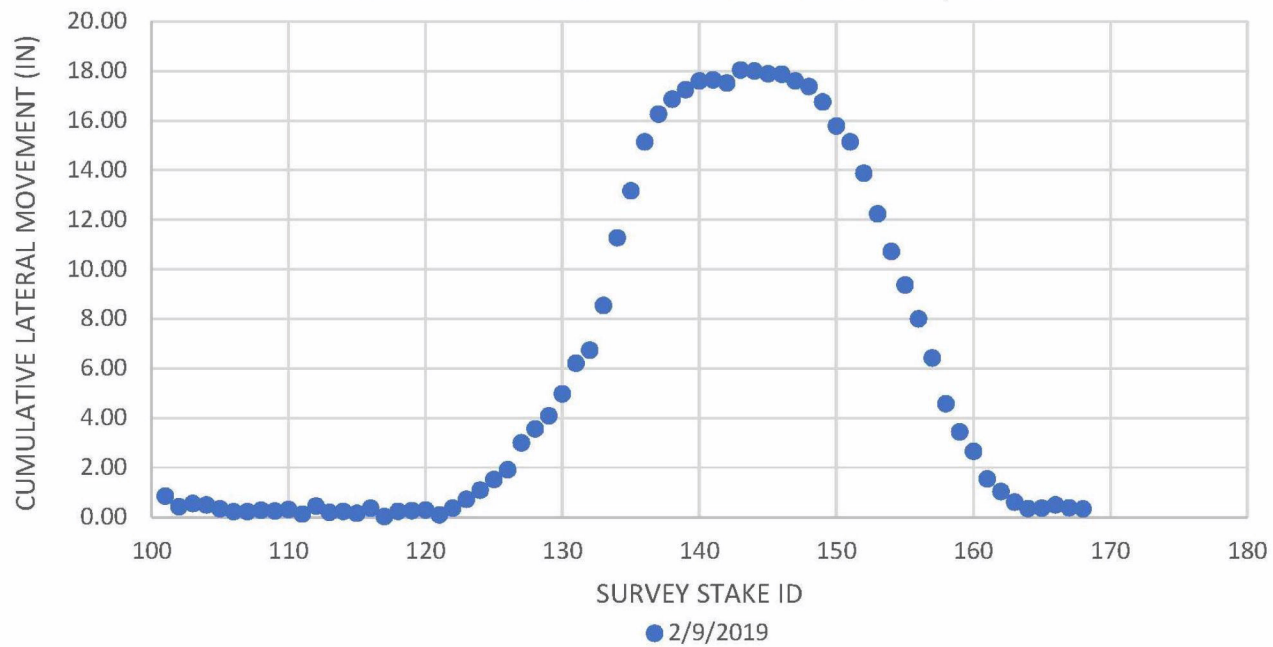
- I. Slope Observations
- II. Water Management
 - a. Stormwater
 - b. Process Water
- III. Near-term Remedial Steps
 - a. Stability Berm
 - b. Factor of Safety
- IV. Contingency Planning
- V. Next Steps



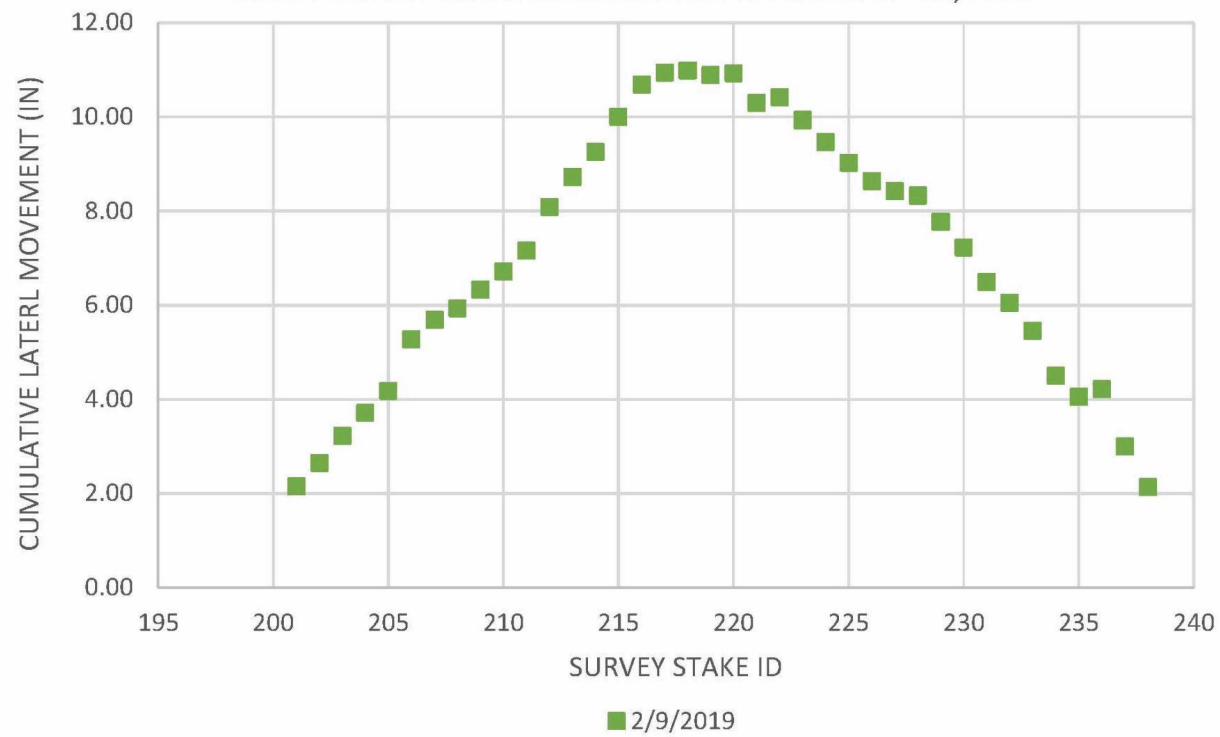




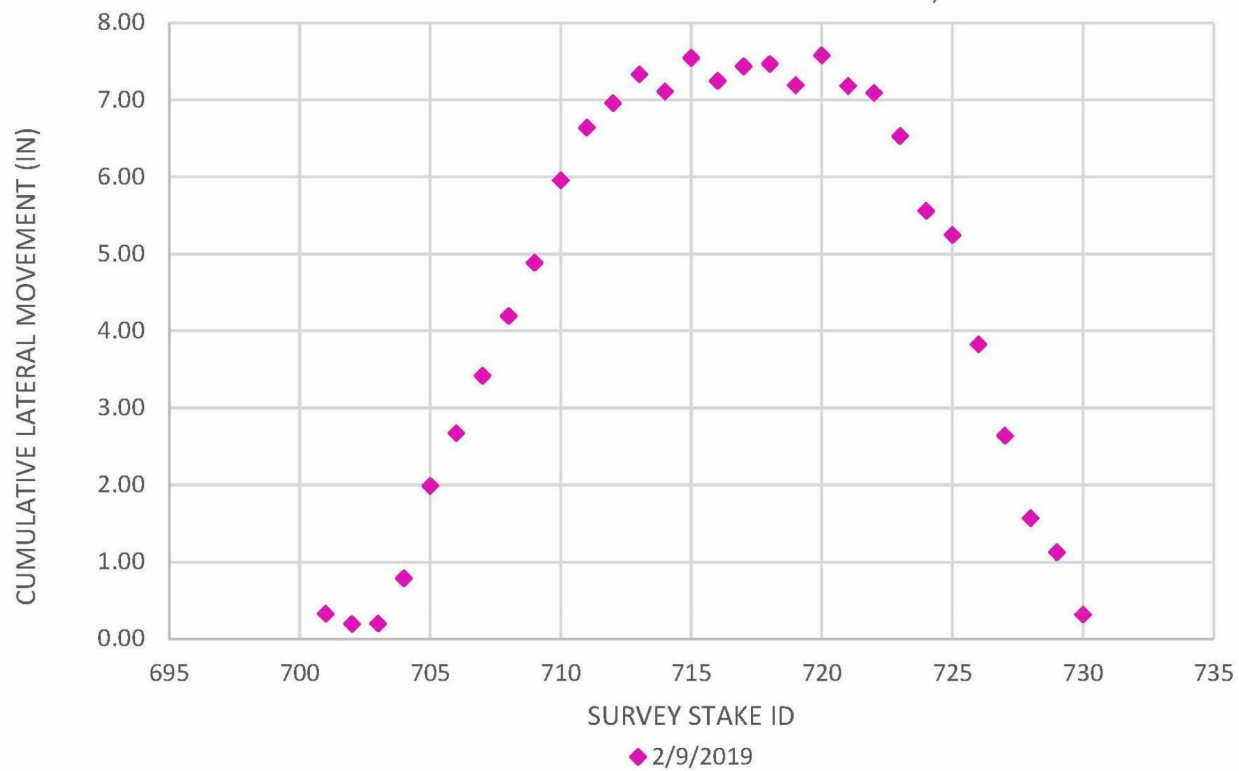
CUMULATIVE LATERAL MOVEMENT ALONG
THE NORTH EARTHEN PERIMETER DIKE
AS OF FEBRUARY 9, 2019
SINCE SURVEY STAKE INSTALLATION ON JANUARY 11, 2019



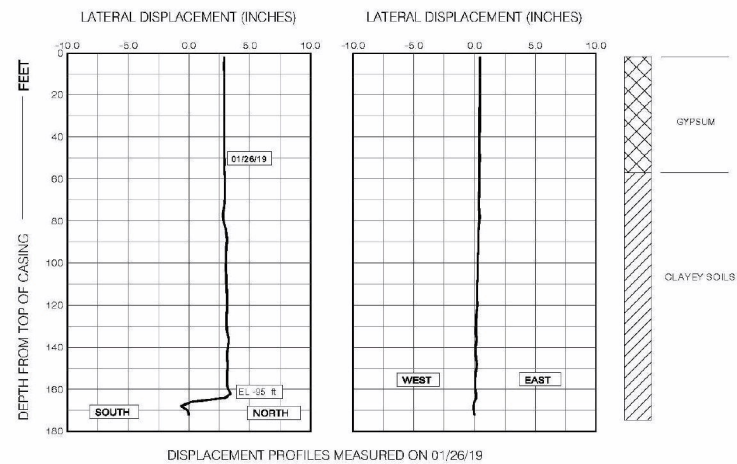
CUMULATIVE LATERAL MOVEMENT ALONG
THE CREST OF NORTH GYPSUM DIKE
AS OF FEBRUARY 9, 2019
SINCE SURVEY STAKE INSTALLATION ON JANUARY 11, 2019



CUMULATIVE LATERAL MOVEMENT ALONG
THE MID-NORTH SLOPE
AS FEBRUARY 9, 2019
SINCE SURVEY STAKE INSTALLATION ON JANUARY 28, 2019



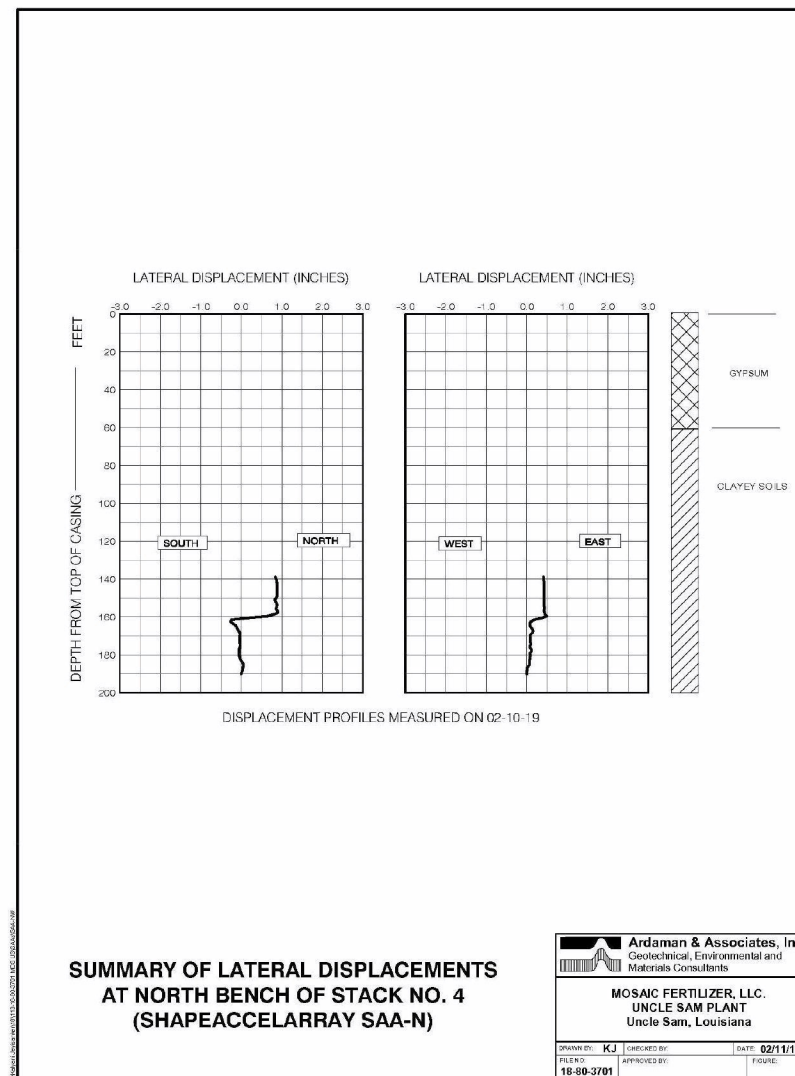
Copyright Ardaman & Associates, Inc. 2019. All rights reserved.

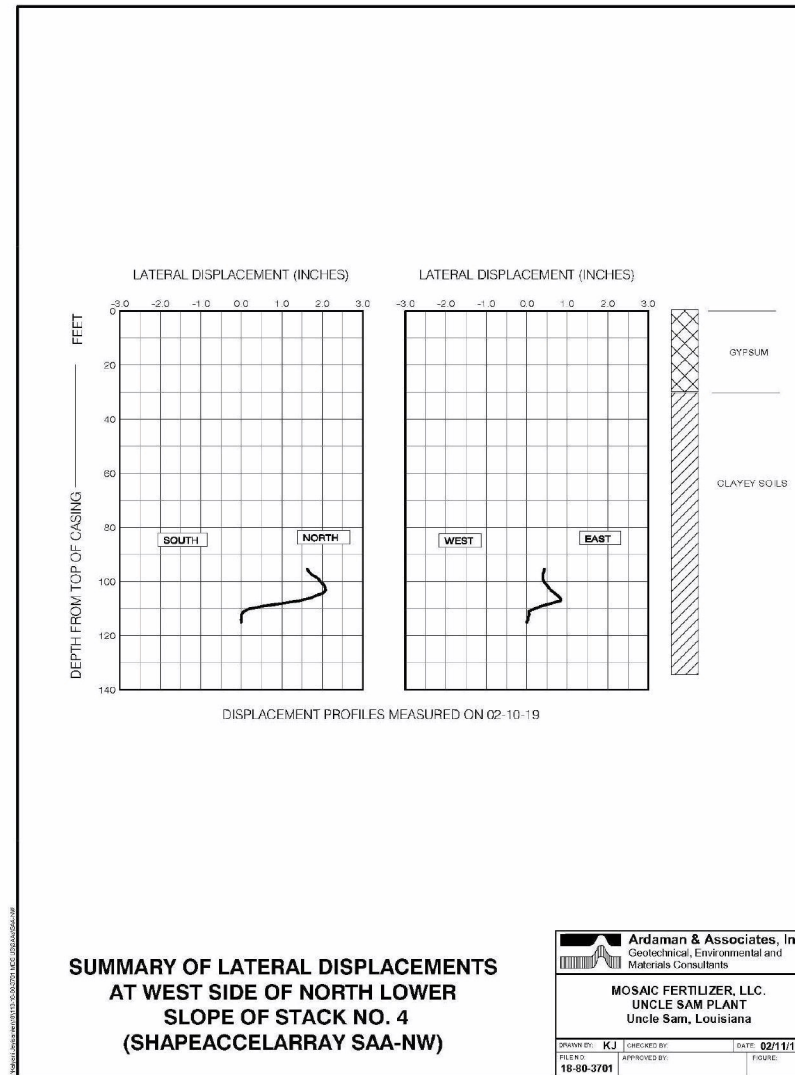


**SUMMARY OF LATERAL DISPLACEMENTS
AT NORTH BENCH OF STACK NO. 4
(INCLINOMETER SI-N2)**

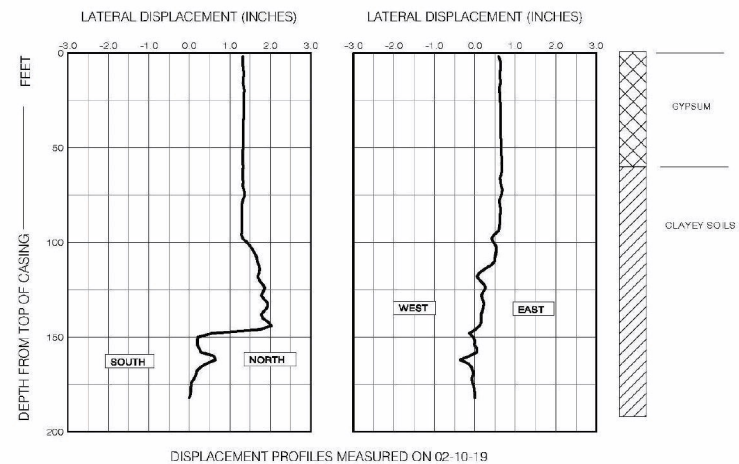
 Ardaman & Associates, Inc. Geotechnical, Environmental and Materials Consultants			
MOSAIC FERTILIZER, LLC. UNCLE SAM PLANT Uncle Sam, Louisiana			
DRAWN BY: KJ	CHECKED BY:	DATE: 01/28/19	
FILE NO: 18-80-3701	APPROVED BY:	FIGURE:	








© Ardaman Associates, Inc. 11/13/18 10:37 AM 18-03701-01

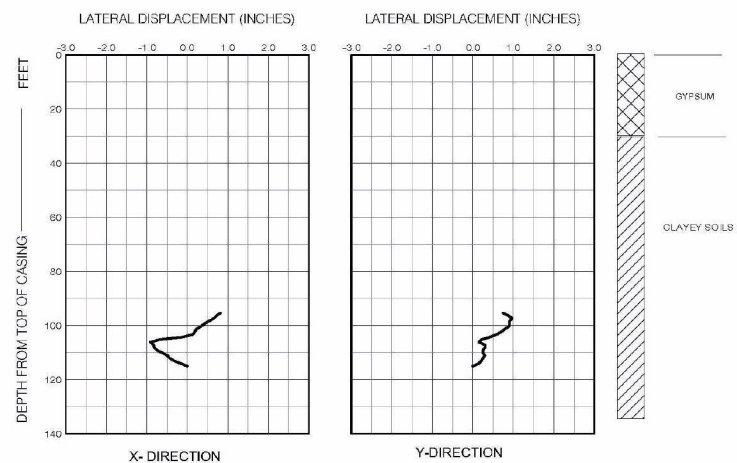


**SUMMARY OF LATERAL DISPLACEMENTS
AT WEST SIDE OF MID-NORTH SLOPE
OF STACK NO. 4
(INCLINOMETER SI-6B)**

 Ardaman & Associates, Inc. Geotechnical, Environmental and Materials Consultants		
MOSAIC FERTILIZER, LLC. UNCLE SAM PLANT Uncle Sam, Louisiana		
DRAWN BY: KJ	CHECKED BY:	DATE: 02/11/19
FILE NO: 18-03-3701	APPROVED BY:	FIGURE:




Project: 16-00-3701-01-0001-1-EC-00000000-0000-0000-0000-00000000-0000



DISPLACEMENT PROFILES MEASURED ON 02-10-19

**SUMMARY OF LATERAL DISPLACEMENTS
AT EAST SIDE OF NORTH LOWER
SLOPE OF STACK NO. 4
(SHAPEACCELARRAY SAA-NE)**

 Ardaman & Associates, Inc. Geotechnical, Environmental and Materials Consultants		
MOSAIC FERTILIZER, LLC. UNCLE SAM PLANT Uncle Sam, Louisiana		
DRAWN BY: KJ	CHECKED BY:	DATE: 02/11/19
FILE NO: 16-00-3701	APPROVED BY:	FIGURE:



Stormwater Management

Proposal for routing storm-water from closed slopes to 004 outfall (110 Acre Reservoir Diversion)

- Existing Let-down pipe →
- Existing 004 pipe →
- Existing Stormwater Conveyance →
- New Pump ⊗
- New HDPE Pipe →
- New Berm —
- Completed Berm —

004
Monitoring

Recently
Completed
Berm

Phase 2
Earthen
Berm

004
Phase 1
Earthen
Berm

Phase 1 berm could provide up to 14 acre ft. of surge capacity and can utilize existing 004 pumps and piping
Reduces pumps and blockages on southern portion of stack.

Phase 2 berm could provide approx. 60 acre ft. of storm water retention

Google Earth



Water Balance as of 2/10/19

.....

Pond	Current Volume (MMGal)	Remaining Capacity (MMGal)
Pond 4	615.0	-
West Cell (Phase 1)	165.5	6.5
Surge Pond	31.3	3.6
Return Ditch	11.4	0.5
110 Acre Reservoir	156.9	212.7
East Cell (Phase 2)	-	-
Updated:	2/10/19 4:00 AM	
Note: East Cell lining expected completion date 3/1/2019		

Process Water Transfer Data and Timeline

Pond	Approx. Current Volume (MMGal)	Approx. Remaining Capacity (MMGal)
Pond 4	605.0	-
West Cell (Phase 1)	165.5	6.5
Surge Pond	31.3	3.6
Return Ditch	11.4	0.5
110 Acre Reservoir	168.0	191.6
East Cell (Phase 2)	-	-
Updated: 2/11/19 4:00 AM		
Note: East Cell lining expected completion date 3/1/2019		



* Assuming average transfer of approximate 10 MMgal/Day

** 250 MMgal up to water el. +10. Remaining 3 ft of design FB to account for 3 months of storm-water.

*** 350 MMgal up to water el. +13. (Design Freeboard - No additional storm-water capacity)

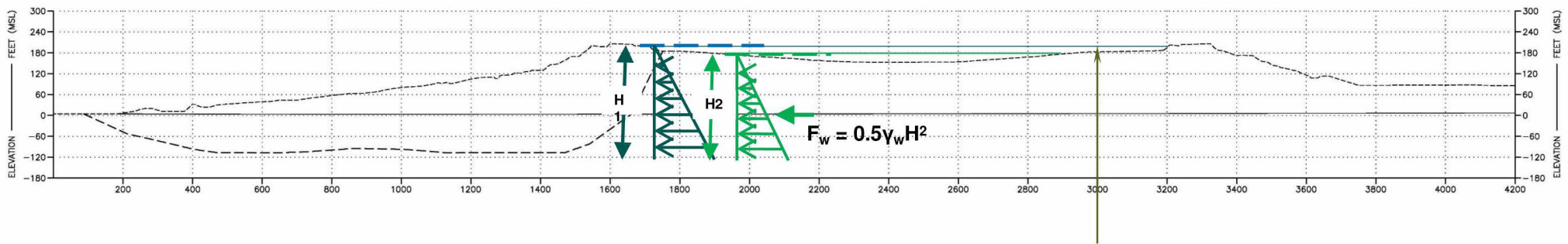
Note: 110 Acre Reservoir Design Freeboard El. +13.0 ft.

Benefits of Continued Operation

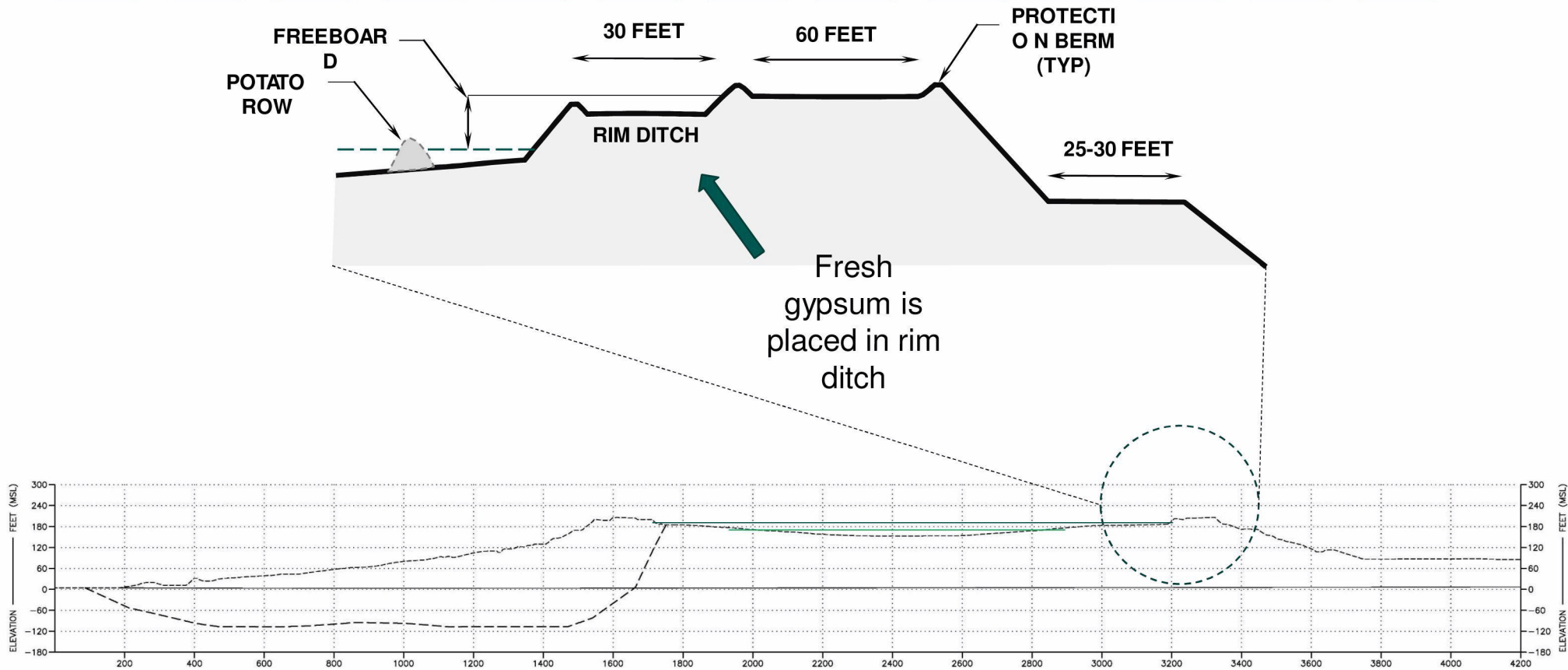
IMPACT OF HYDROSTATIC PRESSURE ON GLOBAL GYPSUM STACK SLOPE STABILITY

$$F_{w1} = 0.5 \cdot 62.4 \cdot 288^2 = 2.59 \text{ MM LB/FT}$$

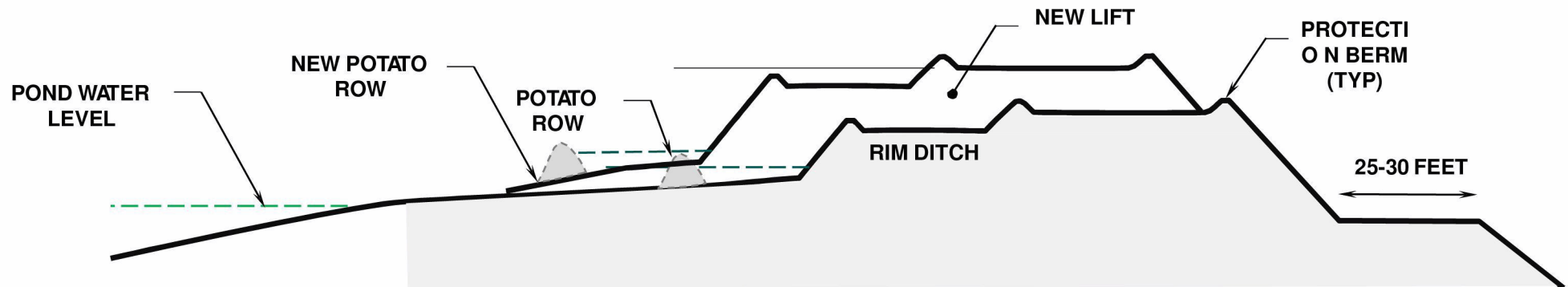
$$F_{w2} = 0.5 \cdot 62.4 \cdot 275^2 = 2.35 \text{ MM LB/FT}$$



OPERATION OF THE SOUTH WALL OF STACK NO.4



Example of A New Lift



Water Balance Impact of Idling Operations

Continued operation of the phosphoric acid plant and gypsum stack system provides three key benefits:

- Water removed in phosphoric acid
- Water tied up in gypsum slurry exceeds phreatic water released into pond
- Water is chemically bound in formation of gypsum
 $\text{Ca}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$

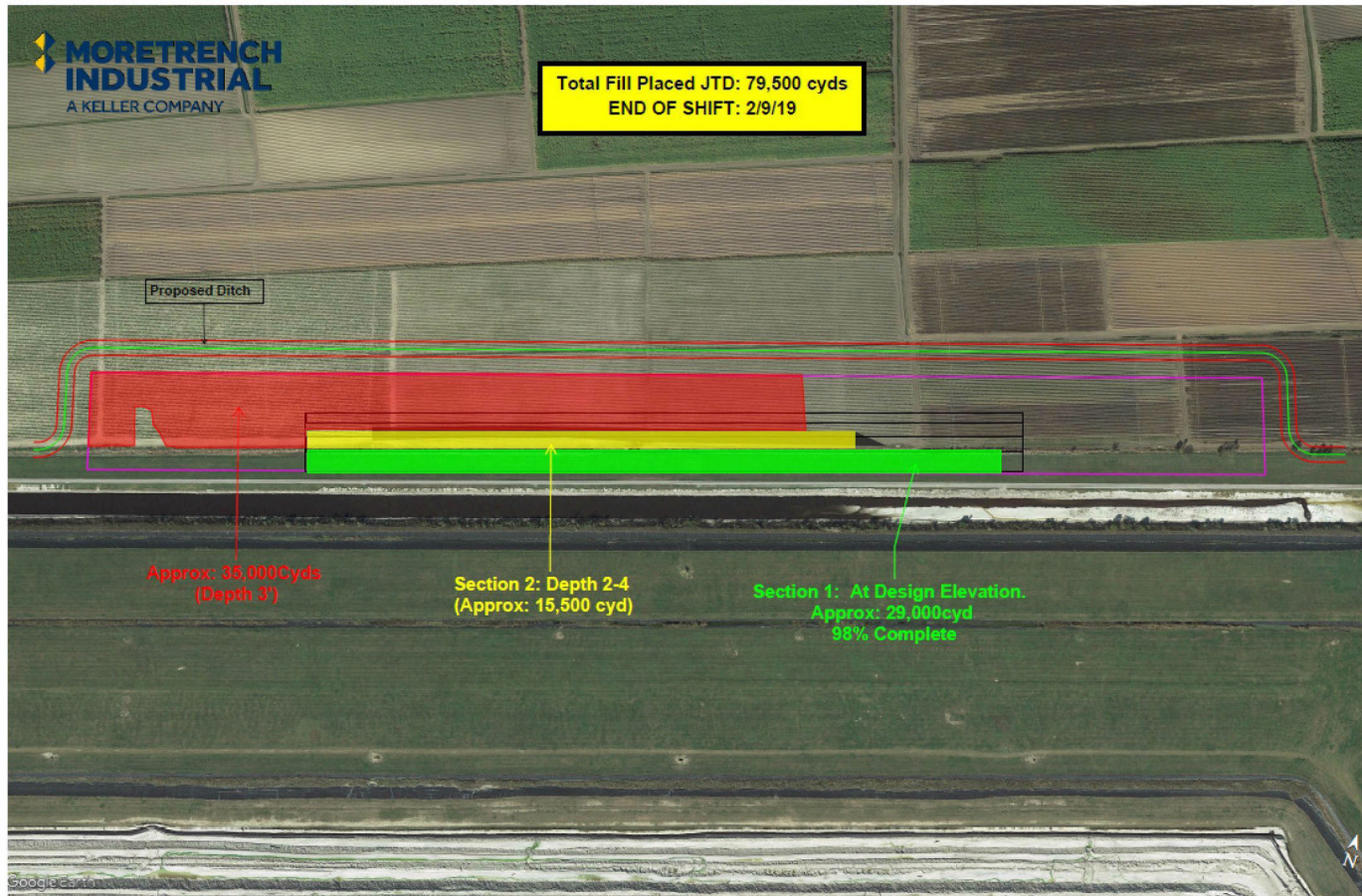
Uncle Sam Process Water Balance				
Approximate Million Gallons Per Year				
Inputs From Operation	34.6	Outputs From Operation	404.6	Inventory Change
Rock Moisture		Phosphoric Acid Moisture		
Fresh Water Inputs	52.6	Gypsum Pore Water	593.0	
Sulfuric Acid Moisture	9.6	Gypsum Hydration Water	168.0	
Process Reaction Water	19.0			
Subtotal	115.8		1,165.6	
Inputs Ongoing	906.8	Outputs Ongoing	700.0	
Rainfall		Injection Wells		
Phreatic Water Consolidation	341.6	Evaporation	434.0	
Stacks 1-3 Drains	70.0			
Subtotal	1,318.5		1,134.0	
Total Including Operation	1,434.3		2,299.6	(865.3)
Total Excluding Operation	1,318.5		1,134.0	184.5
Net Volume Change Operating Versus Down				(1,049.8) million gallons per year
Note: Rainfall input is based on 62" per year				

Summary

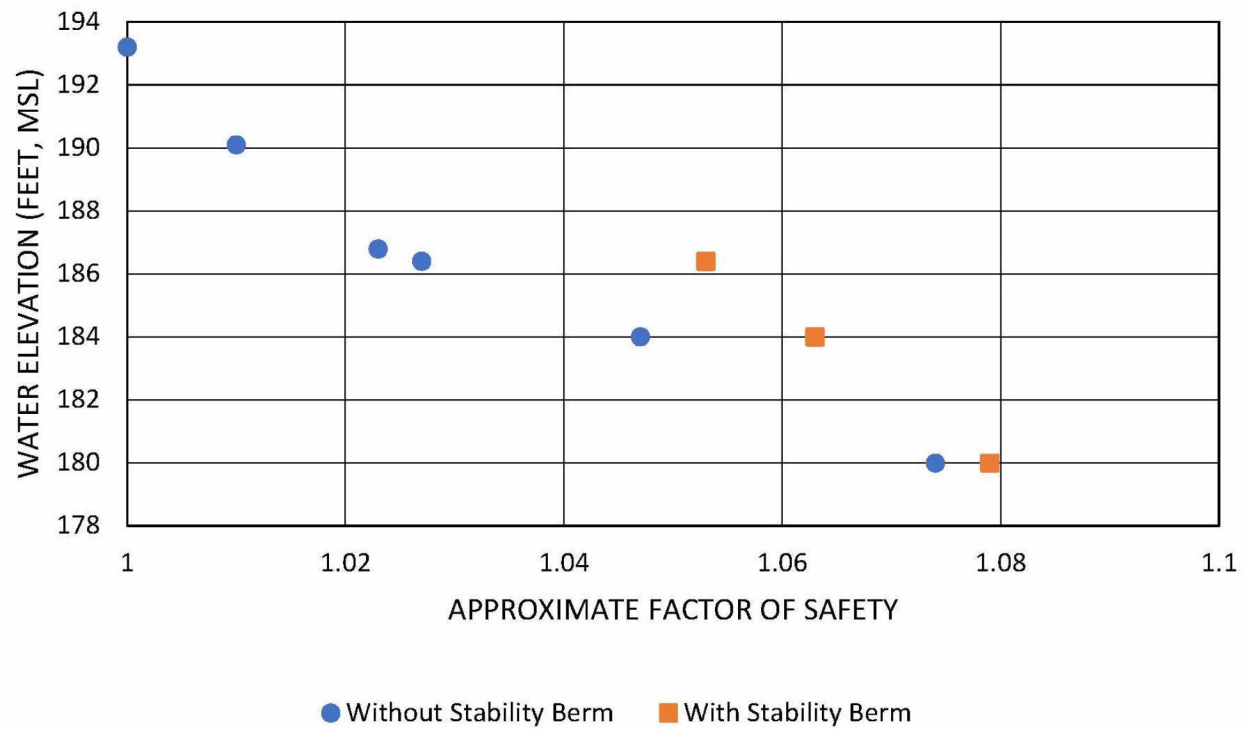
- Operation of the gypsum stack system is beneficial from an overall water balance perspective due to about 2.7M gallons/day being removed as a result of production
- Placement of gypsum on south dike does not increase forces on the north dike due to nature of gypsum placement and lateral distance between the two dikes

Stability Berm Construction as of 2/9/19

.....



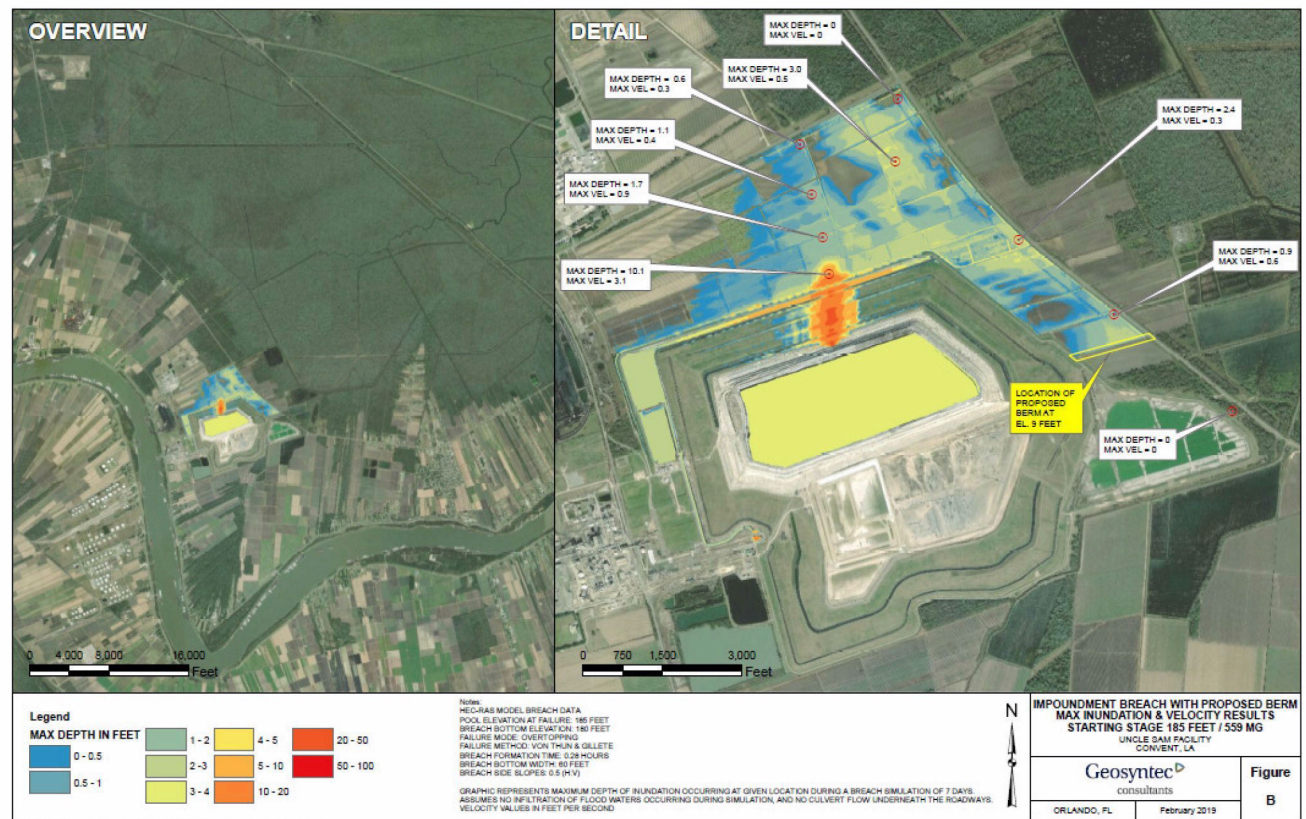
WATER LEVEL ELEVATION ON STACK No. 4 COMPARTMENT
VERSUS APPROXIMATE FACTOR OF SAFETY



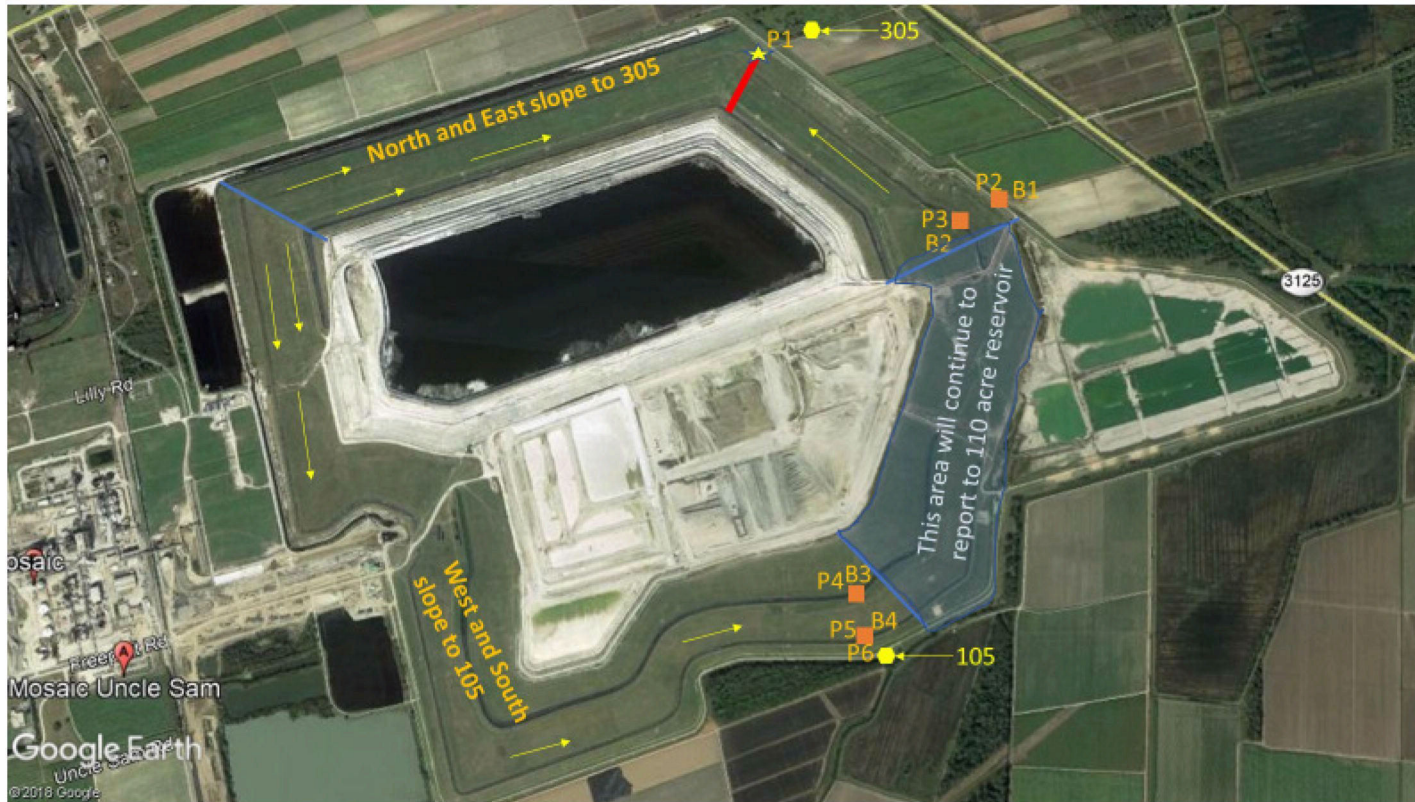
Inundation Scenario 185' to 180' Pond Elevation Change

Key modeling assumptions

- Release volume is worse case scenario with pond at elevation 185' at beginning of failure and 180' at the end
- The initial elevation reflects level after 110 acre reservoir receives 200M gallons
- Release volume is 159M gallons
- Failure mode is unlikely to occur as rapidly as model estimates
- Simulation reflects completion of El. 9' dike between perimeter dike and HWY 3125



Runoff Water Monitoring



pH and
conductivity
probe location

Alarm text at:
3.0 pH
2,500 conductivity